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Moving Map Composer - Personal Computer (MMCPC) Version 1.0 Acceptance Test Proce- dures Developed for the Finnish Air Force

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14. ABSTRACT This document provides detailed Acceptance Test Procedures (ATP) to be followed during the final test and evaluation of the Naval Research Laboratory (NRL) Moving Map Composer - Personal Computer (MMCPC) System, Version 1.0, developed for the Finnish Air Force (FiAF). The ATP was successfully completed by NRL and FiAF representatives at FiAF headquarters in Halli, Finland, in August 2005.					
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MOVING MAP COMPOSER – PERSONAL COMPUTER (MMCPC) VERSION 1.0 ACCEPTANCE TEST PROCEDURES DEVELOPED FOR THE FINNISH AIR FORCE

INTRODUCTION

This document provides detailed Acceptance Test Procedures (ATP) to be followed during the final test and evaluation of the Naval Research Laboratory (NRL) Moving-Map Composer – Personal Computer (MMCPC) System Version 1.0, developed for the Finnish Air Force (FiAF). The ATP was successfully completed by NRL and FiAF representatives at FiAF headquarters in Halli, Finland, in August 2005.

Figure 1 illustrates the data flow between MMCPC, mission planning systems, and the Naval Air Systems Command (NAVAIR) Tactical Aircraft Moving-Map Capabilities (TAMMAC) system installed on FiAF F/A-18 aircraft. MMCPC 1.0 performs the following functions for the FiAF:

- Process FiAF source Georeferenced Tagged Image File Format (geotiff) data into a Compressed Arc Digitized Raster Graphics (CADRG) compatible format that can be read and displayed by TAMMAC;
- Process FiAF or National Geospatial-Intelligence Agency (NGA) source Digital Terrain and Elevation Data (DTED) into a TAMMAC-compatible Re-gridded DTED format (RDTED);
- Define and save regions of interest for mission and theater map data loads;
- Populate these regions of interest with data from user-specified FiAF geotiff files (converted to CADRG-like files via MMCPC), NGA CADRG data, FiAF and NGA RDTED data, and NGA Controlled Image Base (CIB) data;
- Import and convert non-georeferenced images (e.g., Graphics Interchange Format (GIF) files) into TAMMAC-compatible data frames;
- Build Mission Planning and Map Theater data loads from CADRG, RDTED, CIB, and data frames that can be read and displayed by the TAMMAC system;
- Write completed TAMMAC map theater data loads to PC cards for aircraft loading.

MMCPC is installed on a FiAF-owned PC (Dell Dimension 8400). This system's repair tag code is 6M3TQ61, which may be referenced for a complete system configuration on the Dell website (www.dell.com). A summary of the system's configuration includes the following:

- Windows XP Professional Operating System
- 3.4 GHz Pentium 4 Processor
- 1 GB RAM (memory)
- 17" flat panel display
- Amtron Technology IDE interface 16-bit PCMCIA (Personal Computer Memory Card International Association) PC card reader / writer
- 16X DVD +/-RW (DVD reader / writer)
- 160 GB hard disk (RAID configuration) – dual redundancy

TAMMAC performance specifications and database design documents can be found in Boeing (2001) and Harris (2002). Details about the original FiAF MMC system, on which MMCP was based, is provided in Lohrenz et al. (2004). Military specifications for CADRG, CIB, and DTED are documented in National Imagery and Mapping Agency (NIMA) documents MIL-C-89038 (1994), MIL-PRF-89041 (1995), and MIL-PRF-89020A (1996), respectively. GIF and GeoTIFF format specifications can be found in CompuServe (1990) and GeoTIFF Working Group (2000), respectively.

Table 1 lists the source data required (and provided by NRL) to perform this ATP. NRL also delivered as part of this ATP three TAMMAC Map Cards (serial numbers TVV00180, TVV00181, and TVV00182) provided by NAVAIR for the FiAF.

A definition of all acronyms used in this document is provided in Appendix A.

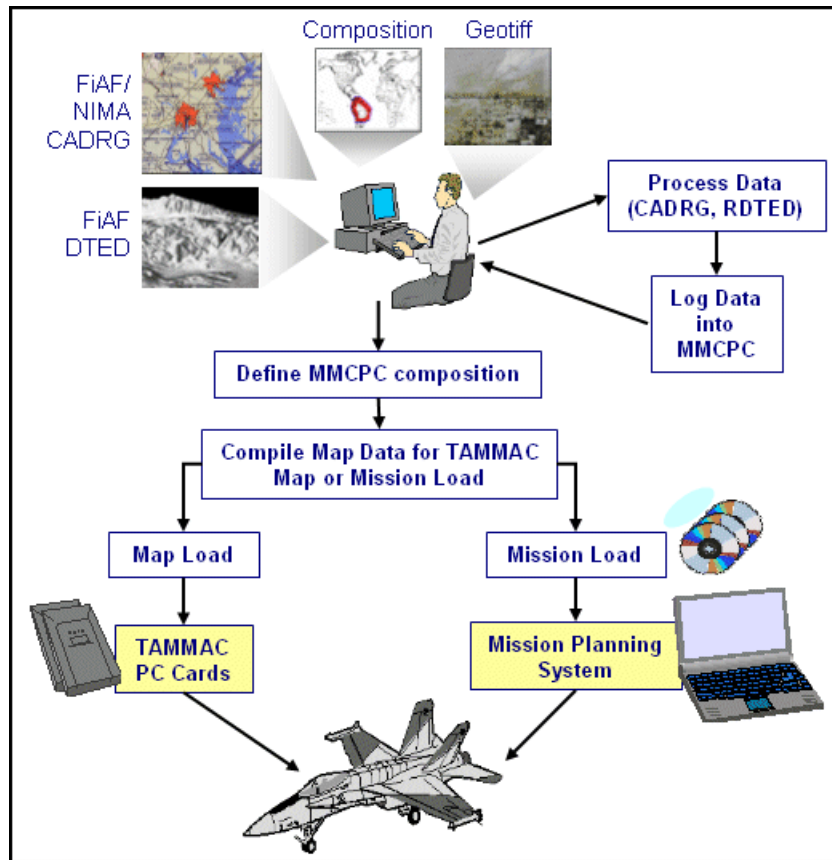


Fig. 1 — Data flow between MMC-PC, Mission Planning, and TAMMAC systems

ATP OVERVIEW

This ATP will test all major functions of MMCP, including logging data, processing data, developing compositions, building and writing map builds (including prioritization of data sources), writing map builds, and custom color palette installation. The ATP is organized into four parts, summarized below.

Part I involves setting up and installing the system, booting and logging in, and checking the peripheral devices.

Part II begins by importing and processing map data into MMCPD, after which all map data to be used during the rest of the ATP will be available in MMCPD for composition development. Map data to be used in this ATP includes NGA CADRG and CIB, processed RDTED from NGA and FiAF source data, processed CADRG from FiAF source data, and non-geographically referenced data frames.

Part III focuses on composition development. A composition defines a geographic region of interest (ROI) based on the available data known to MMCPD (completed in part II). This part of the ATP will test several different methods in which a composition may be defined using various combinations of data types (e.g. CADRG, CIB, RDTED) and scales (e.g. 1:2M, 1:500k). The tester will create and save multiple compositions for use in Part IV of the ATP.

Part IV will use the compositions developed in Part III to build TAMMAC-ready theater and mission data loads. Each data load will contain all necessary map data, defined by its respective composition. MMCPD first writes the theater or mission data load to hard disk in its TAMMAC-ready form. MMCPD then copies theater data loads directly to TAMMAC Map PC Cards. Mission data loads are transferred from MMCPD to the Mission Planning System (MPS), where an additional required file is included before the data is transferred to a TAMMAC mission card.

Table 1 —Source Data Required for MMCPD ATP

Label	Description
FiAF DTED	Finnish DTED Level 1 (~100m post spacing); release date: May 18, 2004
NGA DTED #1	NGA DTED Level 1 (59-69 N latitude)
NGA DTED #2	NGA CADRG Level 1 (66-70 N latitude)
NGA CADRG 1:2M	NGA CADRG at 1:5M, 1:2M. Item number: GNCJNCN, edition 9
NGA CADRG 1:500k #1	NGA CADRG at 1:1M, 1:500k. Item number: ONCTPC05, edition 8
NGA CADRG 1:500k #2	NGA CADRG at 1:1M, 1:500k. Item number: ONCTPC01, edition 7
NGA CADRG 1:250k	NGA CADRG at 1:250k. Item number: SPFIJOGAZ, edition 1
NGA CIB 5m	NGA CIB at 5m. Item number: NP3500, edition: 1
FiAF GTIF	Finnish geotiff source files at 1:2M, 1:500k, and 1:250 scales (Jyvaskyla region) with custom color palettes at all map scales

PART I. SET UP MMCPC SYSTEM**a. Unpack all equipment.****b. Check contents against parts list**

- 1 Personal Computer (PC)
- 1 monitor
- 1 monitor cable
- 1 PCMCIA card drive (pre-installed)
- 1 CD/DVD reader/writer (pre-installed)
- 1 keyboard
- 1 mouse
- 2 U.S./European power cords
- 3 TAMMAC Map Cards
- 1 set of Dell documentation

c. Arrange equipment in workspace

- Place PC on a table with adequate ventilation.
- Place monitor, keyboard, and mouse next to PC.

d. Connect peripherals as described in Dell documentation.**e. Power connections**

This PC may be operated in either U.S. or European power standards. All MMCPC configuration and testing has been conducted using 60Hz, 115VAC. If MMCPC will be operated at 220 V, 50 Hz, verify that the red switch on the back panel of the MMCPC computer is set to 220V for European power. The power supply of the monitor will auto-detect the power source and may be connected without any modifications. The MMCPC system will not have been operated with European power until it is delivered and installed in Finland.

f. Boot MMCPC computer and login

- Allow PC to boot to login screen.
- Enter the following username and password:
Username: **MMCPC**
Password: **FIAFMAP**
- Check the device configuration: right-click on the *My Computer* icon located on the desktop. Verify that the DVD/CD drive is displayed as drive E: and the PC card drive is displayed as drive F:

g. ATP Pass

✓ System boots up correctly and user is able to log in. Yes ☐ No ☐

h. Exceptions Noted:

PART II. IMPORT AND PROCESS MAP DATA

In this section, NGA map data will be imported and processed for use throughout the rest of the ATP. For the FiAF, source data consist of geotiff map files that are processed into CADRG-like map files compatible with the TAMMAC digital map. MMCPD reads geotiff map files from CD and can process multiple scales simultaneously. The volume label and directory structure for the geotiff map files are defined in Appendix B. It is important to note that MMCPD will not process FiAF map data that does not conform to the map data and directory structure formats listed in Appendix B.

In most cases, source FiAF geotiff map files come with a custom set of color palettes for processing the geotiffs into CADRG files. If no custom palettes are available, a default set of color palettes, derived from NGA source data, can be used to process FiAF geotiff into CADRG. NRL recommends that the FiAF use their custom color palettes (rather than the default palettes) to improve color accuracy during conversion to CADRG. There is no need to maintain the default color palettes to use NGA CADRG in combination with processed FiAF CADRG. The user can process multiple data sets with different color palettes without making the previous map data obsolete. The file structure of custom color palette files must conform to the structure listed in Appendix C for MMCPD to properly install and use custom color palettes.

The source data CDs listed in Table 1 are required for this part of the ATP.

1. **Start MMCPD** by double-clicking the MMCPD icon on the desktop.

2. Log NGA Map Data

- a. Insert the CD labeled *GNCJNCN (NSN# 7644014004622)* in the CD drive.
- b. In MMCPD, click **LOG**, then **LOG SOURCE** (or use the shortcut **Ctrl+L**).
- c. Use the **Browse** button on the pop-up window to navigate to the CD drive (E:/), then click **OK**.
- d. Verify that a checkmark appears next to **Found Valid Source Data** and the label name of the source is shown.
- e. Click **LOG**. Verify that the logging process completed successfully. Click **OK**.
- f. Repeat steps 2a-e for each of the following NGA CADRG CDs:
 - *ONCTPC01 (NSN# 7644014496348)*
 - *ONCTPC05 (NSN# 7644014391906)*
 - *JOG-A (expurgated) (Item# SPFIJOGAZ)*
 - *CIB (NSN# 7644014540544)*
- g. This completes the logging process for all NGA map data to be used for this ATP without further processing. All remaining data required for the ATP must first be processed into a form that can be read by TAMMAC.

3. Process the NGA DTED data into RDTEd

- a. Insert the CD labeled *DTED 1 of Finland (N59-N65, E19 – E31)* in the CD drive.
- b. In MMCPD, click **PROCESS**, then **RDTEd** (or type **CTRL+D**).
- c. A window will appear instructing the user to select the source and destination directories for processing. Use the **Browse** button on this window to navigate to the CD drive (E:/). Verify that a checkmark is displayed next to **Found Valid Source Data**.

- d. Use the default destination directory for processing RDTED (C:\mmcp\data\RDTED). Click **Open**. Wait a few moments while MMCP reads DTED data from CD.
- e. An RDTED processing window will be displayed. Note the listing of source DTED files under the 150m and 750m tabs. The same DTED files are used to create both resolutions (150m and 750m) of RDTED. Click **View Coverage** to show the approximate RDTED coverage to result from processing this DTED source.
- f. Zoom into the area of interest by clicking with the right mouse button, selecting **Zoom by Stretch Box** in the menu and using the mouse (with the left button depressed) to zoom.
- g. Click **View Text** to return to the previous view. Since you will be appending more NGA DTED data to this data set, unclick **Finalize Automatically**.
- h. Click **Process** to begin processing the NGA DTED into TAMMAC-ready RDTED files, which will take approximately 3 minutes.
- i. When a message is displayed stating the RDTED processing has completed, click **OK**.
- j. The newly processed RDTED data is not yet ready to use in MMCP, because **Finalize Automatically** was unchecked and MMCP is awaiting more source data to complete RDTED processing. Remove the DTED CD from the CD drive.
- k. Insert the CD labeled *DTED 1 of Finland (N66-N70, E20-E30)* in the CD drive.
- l. Again, click **Process**, then **RDTED** (or **Ctrl+D**).
- m. This time, a window is displayed stating RDTED data exists that has not been finalized. Click **Append**.
- n. A window appears prompting the user to select source and destination directories for processing. Use the **Browse** button at the top of this window to navigate to the CD drive (E:). Verify a checkmark is displayed next to **Found Valid Source Data**.
- o. Since this is an append operation, the destination directory is fixed and cannot be modified. Click **Open**.
- p. An RDTED processing window will be displayed (as in step e). Click **View Coverage** to show the approximate RDTED coverage to result from processing this DTED source.
- q. Click **View Text** to return to the previous view. This is the last set of DTED data to be processed for this data set, so verify that **Finalize Automatically** is checked. Enter the **User Given Name** of NGA DTED.
- r. Click **Process** to begin processing the NGA DTED into TAMMAC-ready RDTED files, which will take approximately 2 minutes.
- s. When a message states RDTED processing has completed, click **OK**. This RDTED data set is now complete. Remove the DTED CD from the CD drive. The processed RDTED data will be verified in the Map Composition Development section of this manual. Note that the MMCP-assigned ID for this data set is **RDTDFIAF0001_A**.

4. Process FiAF DTED into RDTED

- a. Insert the CD labeled FiAF DTED level 1 (May 18, 2004 Release) in the CD drive
- b. Repeat steps b-f from above (the same as processing NGA DTED into RDTED).
- c. Click **View Text** to return to the previous view. Since this is the only DTED data for this data set, verify that **Finalize Automatically** is checked. Enter the **User Given Name** of FiAF DTED.

- d. Click **Process** to begin processing the FiAF DTED into TAMMAC-ready RDTED files, which will take approximately 18 minutes.
- e. When a message states the RDTED processing has completed, click **OK**. This RDTED data set is now complete. Remove the DTED CD from the CD drive. The processed RDTED data will be verified in the Map Composition Development section of this manual. Note that the MMCPD-assigned ID for this data set is **RDTDFIAF0002_A**.

5. Process FiAF GEOTIFF into CADRG

- a. Insert the CD labeled *FiAF source Geotiff – China Lake Test* in the CD drive. This CD contains geotiff files with custom color palettes for each map scale.
- b. In MMCPD, click **Process**, then **CADRG** (or use the shortcut **Ctrl+G**).
- c. A window will appear prompting the user to select source and destination directories for processing. Use the **Browse** button at the top of this window to navigate to the CD drive (E:). Verify a checkmark is displayed next to **Found Valid Source Data**.
- d. Use the default destination directory for processing CADRG (C:\mmcpd\data\CADRG). Click **Open**. Wait a few moments MMCPD reads the FiAF geotiff data from the CD.
- e. Since this CD contains custom color palettes, a message will inform the user that a new color palette was detected for the appropriate map scale (here, 1:2M, 1:500k and 1:250k) and warn about possible repercussions of installing new color palettes. Click **Continue**.
- f. A **CADRG Processing** window will be displayed. Note the listing under each map scale tab that contains geotiff files. For CADRG processing, each geotiff file is processed for only the scale for which it is associated. Click **View Coverage** to show the approximate CADRG coverage that will result from processing these FiAF geotiff source files. Click through each of the scale tabs to see the coverage for each scale.
- g. Click **View Text** to return to the previous view. Since this is the only FiAF geotiff source CD for this data set, verify that **Finalize Automatically** is checked. Enter the **User Given Name** of FiAF CADRG ATP.
- h. Click **Process** to begin processing the FiAF geotiff files into TAMMAC-ready CADRG-like files. This is a CPU-intensive process, due to spatial and color compression to create CADRG files, and will take about 2 hours to complete.
- i. When a message states CADRG processing has completed, click **OK**. This CADRG data set is now complete. Remove the FiAF geotiff source CD from the CD drive. The processed CADRG data will be verified in the Map Composition Development section of the ATP. Note that the MMCPD-assigned ID for this data set is **CDRGFIAF0001_A**.
- j. Verify that all map data in this section has been logged and properly processed:
 - From the MMCPD main window, click **Compose**, then **Include Coverage**, then **Logged Source**.
 - Verify that the logged source listing includes all sources that have been logged and processed during this session.
 - Double-click on **RDTDFIAF0001_A**. Set **MMCPD Data Type** to **RDTED** and set **MMCPD scale** to **150m**, then move the cursor to the processed coverage area. Right-click, select **View RPF Data**, and verify that the RDTED coverage is correct.
 - Repeat steps 1-2, and then double-click on **CDRGFIAF0001_A**. Set **MMCPD Data Type** to **CADRG** and **MMCPD scale** to **1:2M**. Right-click, select **View RPF Data**, and verify that the CADRG coverage is correct.

- Close the View RPF Data window. From the MMCPD main window, click **File**, then **New**. Click **No** when prompted to save the current composition.

6. Process Data Frames

- a. A set of images has been installed with MMCPD for the ATP. From the MMCPD main window, click **Process**, then **Dataframe** to display the Dataframe Viewer window.
- b. In the Dataframe Viewer window, click **File**, then **Open Image File**. The default directory (C:\MMCPD\IMPORT) contains four image files, of which three will be processed for this ATP. Double-click on the first image filename (AUSTIN.GIF). Verify that the data frame image is displayed in the Viewer window.
- c. From the Viewer window, click **File**, then **Save As Dataframe**. In the Save As window, save the data frame as AUSTIN.HDF, a TAMMAC-ready data frame file.
- d. Repeat steps b-c for images DREVIL.GIF and STOOGIES.GIF. Save the data frame files as EVIL.HDF and STOG.HDF, respectively.
- e. Verify that the data frames were properly saved by opening each one in the viewer. From the viewer menu, click **File**, then **Open Image File**. Browse to the directory C:\MMCPD\data\dataframes. Double-click on a saved data frame and verify it is correct in the Viewer window.
- f. From the Dataframe Viewer menu, click **File, Exit**.

7. ATP Pass:

- ✓ All NGA data has been logged and FiAF source data has been processed and is correct.

Yes ☐ No ☐

8. Exceptions Noted:

PART III. MAP COMPOSITION DEVELOPMENT

In Part II, you processed and imported all the map data that will now be used to define regions of interest (i.e., compositions) which, in turn, will be used in Part IV. In this section, you will use several different methods to generate map compositions. These compositions will form the basis for the TAMMAC map theater and mission data loads that will be created in Part IV. One method for defining map compositions is via an MPS ASCII import file. The format of this file is defined in Appendix D.

1. Define Composition using Logged Sources

- a. From the MMCP main menu, click **Compose**, then **Include Coverage**, then **Logged Source**.
- b. A window should be displayed listing the logged sources available for composition development. Verify there is one CIB source, four NGA CADRG sources, one FiAF CADRG source, and two RDTED sources.
- c. Double-click the CIB source, verify that CIB map coverage in central Finland is displayed.
- d. Repeat step a and select the NGA CADRG source **CDRGXSPFIJOGAZ_1**. Verify the map coverage. Note that you may need to change the MMCP Data Type to **CADRG** and the MMCP Map Scale to **1:250k**.
- e. Repeat step a and select the RDTED source **RDTDFIAF0001_A**. Verify the map coverage for both RDTED scale (150m and 750m).
- f. From the MMCP main window, click **File, Save**. Enter the composition name as **ATP1**. The composition will be saved as an unlocked composition. Click **OK**.
- g. From the main window, click **File, Close**. Verify the composition has been closed.
- h. From the main window, click **File, Open**. Double-click on the composition **ATP1**. Verify all map data included in the composition was properly saved:
 - Data type: CIB, scale: 5m.
 - Data type: CADRG, scale: 1:250k.
 - Data type: RDTED, scale: 150m.
 - Data type: RDTED, scale: 750m.
- i. From the main window, click **COMPOSE**, then **VERIFY COMPOSITION**. Click the radial button for **Theater**. Verify the current composition is a valid theater map for TAMMAC, and note how many map cards are needed.



NOTE: The calculation used to determine maximum theater / mission size, map card size, and mission card size are defined in a configuration file that may be modified as PC card sizes change. The current maximum capacity setting for theater map cards is 1.0GB. The current maximum capacity setting for mission cards is 256MB.

- j. Once verified, click **File**, and then **Close**.

2. Define Composition using Another Composition and Logged Sources

- a. From the MMCPC main window, click **Compose**, then **Include Coverage**, and then **Composition**. Double-click the composition **ATP1**.
- b. Add additional coverage to this composition by following procedure (1) above to include the logged source **CDRGXGNCJNCN_9**. Verify that map data now exists for data type **CADRG** at map scales **1:5M** and **1:2M**.
- c. Add additional coverage to this composition by following procedure (1) above to include the logged source **CDRGXONCTPC05_8**. Verify that map data now exists for data type **CADRG** at map scales **1:1M** and **1:500k**.
- d. From the MMCPC main window, click **File, Save**. Enter composition name **ATP2**. The composition will be saved as an unlocked composition. Click **OK**.
- e. From the main window, click **File, Close**. Verify the composition has been closed.
- f. From the main window, click **File, Open**. Double-click on the composition **ATP2**. Verify all map data included in the composition was properly saved.
 - Data type: CIB, Scale: 5m.
 - Data type: CADRG, Scale: 1:250k.
 - Data type: CADRG, Scale: 1:500k.
 - Data type: CADRG, Scale: 1:1M.
 - Data type: CADRG, Scale: 1:2M.
 - Data type: CADRG, Scale: 1:5M.
 - Data type: RDTED, Scale: 150m.
 - Data type: RDTED, Scale: 750m.
- g. From the main window, click **COMPOSE**, then **VERIFY COMPOSITION**. Click the radial button for **Theater**. Verify the current composition is a valid theater map for TAMMAC and note the number of map cards needed.
- h. Once verified, click **File, Close**.

3. Define a Composition using the MMCPC Composition Toolbar

- a. From the MMCPC main window, click **File**, then **New**.
- b. Show all available map coverage by clicking **View** from the main menu, then checking **Available Coverage (toggle on)**. Using the **Data Type** and **Scale** pull-down windows, click through each data type and map scale selection. Note the map coverage bitmaps are green, which indicates the coverage is available but not part of the current composition (map segments are red for compositions).
- c. Use the **Zoom Stretchbox**  to zoom into the Scandinavian region. Once the button has been depressed, the cursor should change from an arrow to a cross (+). Depress the left mouse button at the upper left-hand corner and drag it to the lower right-hand corner of the desired zoom box.
- d. Click the **Zoom Stretchbox**  again to return the cursor to an arrow.
- e. Change data type to **CADRG** and scale to **1:250k**. Green map segments should be displayed for the entire country of Finland. Use the **Define Coverage by Stretchbox** tool to select the lower half of Finland. Depress the button to activate the function, hold down the left mouse button from the upper left-hand corner and drag to the lower right-hand corner of the desired coverage. A purple box should be displayed showing the extents of the stretchbox and the map segments within the box should now be red (indicating they are part of the current composition).

- f. Change scale to **1:500k**. Use the **Define Coverage by Polygon** tool to select the territorial boundaries of Finland. Depress the button to activate the function; then, starting at the bottom, left-click a location just below Helsinki. A purple dot should appear. Continue to left-click on points just outside the boundaries of Finland. Line segments will be displayed for each point clicked. After clicking around the boundaries of Finland, double-click to close the polygon. The map segments within the polygon should now be red.
 - g. Following procedure (1) above, include logged source **RDTDFIAF0001_A**.
 - h. Change data type to **RDTEd** and map scale to **150m**. If needed, use the **Zoom Out** tool to see all RDTEd coverage. Use the **Erase Coverage by Stretchbox** tool to remove the northern half of RDTEd coverage. Depress the button to activate the function, hold down the left mouse button from the upper left-hand corner and drag to the lower right-hand corner of the desired coverage. A purple box should be displayed showing the extents of the stretchbox and the map segments within the box should now be removed. Note that the **Define Coverage** toolbar is inactive at the 750 m scale. However, the actions taken at the 150 m scale for RDTEd are automatically applied to the 750 m scale. Note in this case that no change at the 750 m scale occurred because the reduced bounds at the 150 m scale still intersected the same 750 m RDTEd files.
 - i. To associate the data frames created in Part II with this composition, from the main window, click **Compose**, then **Associate DF**.
 - j. A **Select Dataframes** window will be displayed. Since the data frames were stored in the default location (C:\MMCPD\data\dataframes), the three data frames created in Part II should be listed. Select all three by placing the cursor below and to the right of the last data frame, then depress the right mouse button and drag to the upper-left data frame. Click **Open** to associate the data frames.
 - k. From the MMCPD main window, click **File, Save**. Enter composition name **ATP3**. The composition will be saved as an unlocked composition. Click **OK**.
 - l. From the main window, click **File, Close**. Verify the composition has been closed.
 - m. From the main window, click **File, Open**. Double-click on composition **ATP3**. Verify that all map data included in the composition was properly saved:
 - Data type: CADRG, Scale: 1:250k.
 - Data type: CADRG, Scale: 1:500k.
 - Data type: RDTEd, Scale: 150m.
 - Data type: RDTEd, Scale: 750m.
 - n. From the main window, click **COMPOSE**, then **VERIFY COMPOSITION**. Click the radial button for **Theater**. Verify that the current composition is a valid theater map for TAMMAC and note the number of map cards needed.
 - o. Verify the data frames have been properly associated to this composition by right-clicking on the composition toolbar. A window will be displayed showing the active toolbars. Toggle on the **Associated Dataframes** toolbar. A pulldown menu will be displayed showing each data frame associated with the current composition.
 - p. Once verified, click **File, Close**.
4. **Create a Mission Composition via MPS file**
- a. A pre-defined MPS file has been created for this ATP. The file resides in directory C:\MMCPD\import. From the MMCPD main window, click **View**, then **Available Coverage** (toggle on) to view all logged map coverages. From the main window, click **File, Import**.

- b. A window should be displayed to select the file to be imported. Find **MPSIMPORT.MPS** in the default directory and double-click to select this file.
- c. MMCPC should create a composition based on the data types, map scales, and extents that are listed in the MPS file. Verify that the current composition contains the coverage listed in the MPS file (see Appendix D, Figure D-2).

NOTE: The resulting composition will only contain the MPS-requested map coverage for which logged sources exist. In other words, not all data requested in an MPS file may actually exist and be part of the composition. To check this case, compare the available coverage (in green) to the MPS coverage (in red). If MPS coverage is missing, no available coverage should exist.

- d. Verify the data frames listed in the MPS have been processed and associated with the current composition by reviewing the listing of data frames in the **Associated Dataframes** toolbar.
- e. From the main window, click **COMPOSE**, then **VERIFY COMPOSITION**. Click the radial button for **Mission**. Verify the current composition is a valid mission map for TAMMAC.
- f. When verified, from the main window, click **File, Save**. The name of the composition is provided in the MPS file (**ATP4**) and will be displayed as the default. Click **OK**.
- g. Click **File, Close**.

5. **ATP Pass:**

- ✓ Methods used to create the four compositions worked as expected and data frames were properly associated.

Yes ☐

No ☐

6. **Exceptions Noted:**

PART IV. MAP THEATER AND MISSION BUILDS

Four compositions were developed in Part III that defined regions of interest based on the map data imported and processed from Part II. In this section, the TAMMAC-ready theater and mission data loads will be rebuilt from the compositions developed in the previous section. The TAMMAC-ready theater data loads will include the FiAF-released TAMMAC files for configurable parameters and symbol set files. In MMCP, all data loads are first written to hard disk. Theater loads can then be written to TAMMAC Map PC cards. However, the mission loads require an additional file from the MPS. The MPS reads mission loads from the hard disk, includes the necessary file, and writes the mission load to a TAMMAC Mission PC card.

1. Build TAMMAC Map Loads

- a. From the MMCP main menu, click **Build**, then **Build Map** to display the **Build Map** window.
- b. Click the **Theater** radial button on the **Build Map** window to indicate that this map build will be a TAMMAC Theater Build (maximum of 3 GB). Click the **Browse** button to view the available compositions. Double-click the composition **ATP1**. Click **OK**.
- c. The **Build Map** window will close, and the **Data Sources** window will be displayed. This window displays all possible map sources for the selected composition. Click **OK** to accept the default order (prioritization) of sources.

NOTE: Map data sources may have overlapping coverage. The **Data Sources** window allows the user to set the precedence for data sources to be used in constructing the map build (top is highest priority). Order of precedence may be of importance when newer map data overlaps older data or when the user needs to prioritize the source provider (e.g., use FiAF data before NGA data). The user can change the precedence order by clicking (selecting) a particular source and using the up and down arrow buttons to set the order.

- d. If data frames are associated with the composition, another window will be displayed showing the list of data frames. Again, precedence can be changed via up and down arrows. The order of precedence for data frames will determine the order in which the data frames will be displayed in the aircraft (top is first). Click **OK**. For the ATP, this is applicable to ATP3 and ATP4 builds only.
- e. The build process will begin. For sources on CD, MMCP will instruct the user to insert the source disk in the CD and click **OK** to continue. When the **Build Finished** window is displayed, click **OK**.
- f. Repeat steps a-e for composition ATP2, with one exception: change the data sources' order of precedence such that source **CDRGFIAF0001_A** has a higher priority than **CDRGXSPFIJOGAZ**.
- g. Repeat steps a-e for composition ATP3, with two exceptions: 1) change the data sources' order of precedence such that source **RDTDFIAF0001** has a higher priority than **RDTDFIAF0002**. and 2) change the data frames' order of precedence such that the FAF data frame is first.
- h. Repeat steps a-e for composition **ATP4** with one exception: click the **Mission** radial button on the **Build Map** window.
- i. When ATP4 is completed, click **OK** in the **Build Finished** window.

2. Write TAMMAC Theater Loads to PC Card

- a. From the MMCP main window, click **Build**, then **Write Theater Map**. Double-click the theater map **ATP1**.
- b. A window will be displayed instructing the user to enter the serial number of the first PC card. Type **TVV00182**, insert this card into the PC card drive, and click **OK**.

- c. The theater map **ATP1** is a single card load. Click **OK** when the write has completed. Eject the card from the PC card drive and mark this card as **ATP1**.
- d. Repeat step a, but double-click the theater map **ATP2**. Enter the serial number of the PC card, insert that card into the PC card drive and click **OK**. Since **ATP2** is a multi-card load, you will be prompted after the first card has completed to enter the second card's serial number and insert that card. Eject the first card, enter the serial number and insert the second card.
- e. Repeat steps a-d for compositions **ATP2** (use **TVV00xxx**) and **ATP3** (use **TVV00xxx**).
- f. Load the **ATP1** PC card in the TAMMAC system (located in the Scientific and Technical Information Center (STIC) facility) for verification. Note the following during review:
 - View and verify the accuracy of CADRG map data (NGA source) at the 5 nmi scale.
 - View and verify the accuracy of RDTED data (FiAF source) at 80, 40, 20, and 10 nmi scales. (FiAF source DTED is higher quality than NGA DTED.)
 - View and verify the accuracy of CIB map data at the 5m scale.
- g. Load the **ATP2** PC cards in TAMMAC for verification. Note the following during review:
 - View and verify the accuracy of CADRG map data at 5 nmi scale. Having changed the order of precedence for CADRG, this is now from FiAF source.
 - View and verify the accuracy of RDTED data at the 80 nmi, 40 nmi, 20 nmi, and 10 nmi scales. The precedence was not changed for RDTED, which is still FiAF source.
 - View and verify the accuracy of CIB map data at the 5m scale.
 - View and verify the accuracy of the CADRG map data at the 40 nmi and 20 nmi scales (both FiAF source, due to the precedence order). Both scales display the same set of CADRG data.

NOTE: The ATP2 composition included map coverage at 1:5M and 1:1M scales. However, the F-18 operational flight program (OFP) only displays CADRG at 1:250k, 1:500k, and 1:2M scales. The 1:5M CADRG was included in this composition to demonstrate that 1:5M and 1:1M scale data will not be accessed by the map display. Normally, the user would only include map coverage for the three supported scales.
- h. Repeat steps a-c for **ATP3**, re-using the **ATP1** PC card.
- i. Load the **ATP3** PC card in TAMMAC for verification. Note the following during review:
 - View and verify the accuracy of 5 nmi CADRG map data (here, still NGA source).
 - View and verify the accuracy of 10 nmi CADRG map data (NGA source).
 - View and verify the accuracy of RDTED data at 80, 40, 20, and 10 nmi scales. Since the order of precedence was changed for RDTED, this is now NGA source. Note the poorer quality of the terrain data.
 - View the data frames and note that the AUSTIN image is displayed first, per the order of precedence set during the map build.
- j. The **ATP4** map build cannot be verified as part of the MMCPD ATP, since it requires additional information from the MPS system to be a valid TAMMAC mission load.

3. ATP Pass:

- ✓ All TAMMAC map loads were created successfully, and all TAMMAC theater loads were successfully written to TAMMAC PC cards and verified in the STIC facility.

Yes ☐ No ☐

4. Exceptions noted:

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- NIMA (1996). *Military Specification for Digital Terrain Elevation Data (DTED)*, MIL-PRF-89020A.

Appendix A

ACRONYMS

ASCII	American Standard Code for Information Exchange
ATP	Acceptance Test Procedures
CADRG	Compressed Arc Digitized Raster Graphics
CIB	Controlled Image Base
CD-R	Compact Disk – Recordable
DF	Data Frame
DTED	Digital Terrain Elevation Data
FiAF	Finnish Air Force
GB	Gigabyte
GEOTIFF, GTIF	Geo-referenced Tagged Image Format
IDE	Integrated Drive Electronics
MMCPC	Moving Map Composer – Personal Computer
MPS	Mission Planning System
NAVAIR	Naval Air Systems Command
NGA	National Geo-Intelligence Agency
NRL	Naval Research Laboratory
NSN	National Stock Number
OFP	Operational Flight Program
PCMCIA	Personal Computer Memory Card International Association
RAID	Redundant Array of Inexpensive Disks
RAM	Random Access Memory
RTED	Re-gridded Digital Terrain Elevation Data
ROI	Region of Interest
STIC	Scientific and Technical Information Center
TAMMAC	Tactical Aircraft Moving-Map Capability

Appendix B

SOURCE MAP DATA AND DIRECTORY STRUCTURE FORMAT

INTRODUCTION

Appendix B provides detailed information on the data format and directory structure of the Finnish source map data to be processed by MMCPD version 1.0. In addition to the Finnish-specific map data that MMCPD 1.0 supports (defined below), MMCPD is also designed to read the following data types and associated directory structure:

- Compressed Arc Digitized Raster Graphics (CADRG): *Military Specification for the Compressed ARC Digitized Raster Graphics, MIL-C-89038, October 1994.*
- Controlled Image Base (CIB): *Performance Specification for Controlled Image Base, MIL-PRF-89041, May 1995.*
- Digital Terrain Elevation Data (DTED): *Performance Specification for Digital Terrain Elevation Data, MIL-PRF-89020A, April 1996.*

The following sections consist of Finnish-specific data types that are processed and supported in MMCPD to produce TAMMAC theater and mission data loads per Appendix G of the document referenced below:

- *Performance Specification for the TAMMAC Digital Map System, PS 74-870260 revision D, March 2001.*

FIAF GEOTIFF FILE FORMAT AND DIRECTORY STRUCTURE

MMCPD 1.0 supports files that conform to the geotiff format specification version 1.8.1 (see <http://www.remotesensing.org/geotiff/spec/geotiffhome.html> for a complete definition). MMCPD has tested sample Finnish geotiff map data and will support both Model Transformation Tag and Model Pixel Scale / Model Tiepoint Tag geocoding. However, due to cost constraints, MMCPD cannot extensively test all possible geocoding and geokey combinations, but has successfully tested Finnish implementations used to date. For MMCPD to identify and process source media, all FIAF geotiff CDs *must* have a volume identification of **FIAF_GTIFF**. Otherwise, MMCPD will *not* process the map data. The geotiff producer is responsible for providing the CD volume identification.

A FIAF geotiff CD may contain any number of geotiff files for *multiple* map scales and one optional custom color palette file (discussed in Appendix C) for each map scale that contains geotiff files. All geotiff files must contain a *TIF* suffix (e.g., *ABCDEFGH.TIF*) and all files must conform the directory structure shown in figure B-1.

The Finnish MMCPD 1.0 system is initially installed with a default set of CADRG color palettes extracted from NGA source. For any map scale directories containing source geotiff files that do not contain a custom color palette, the default CADRG palette for that map scale will be used to process the source geotiff into CADRG. Once a custom color palette has been installed for a given map scale, that custom color palette becomes the default for that map scale.

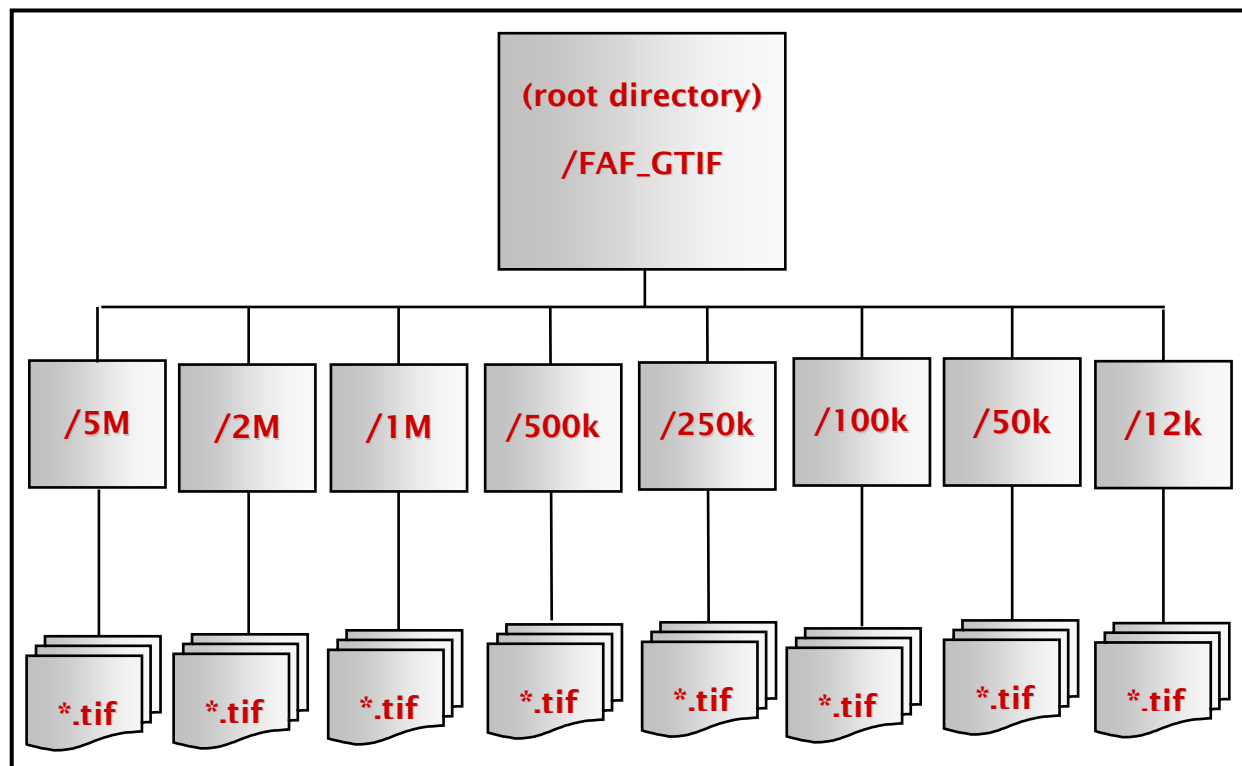


Fig. B1 — FiAF source geotiff directory structure

FiAF DTED FORMAT

The FiAF DTED files must conform to the structure defined in section 3.14 of MIL-PRF-89020A, *Performance Specification Digital Terrain Elevation Data* (April 1996).

MMCPC 1.0 will support *only* DTED level 1. DTED level 1 post (elevation) spacing is defined in section 3.9 of the DTED military specification.

The directory structure *and* file naming convention of FiAF DTED must conform to the format defined in section 3.14.2 of the DTED military specification, *with the exception* that FiAF DTED is not required to have a gazetteer, a DMED file, text files, or the GAZETTE or TEXT directories.

Appendix C

FIAF CUSTOM COLOR PALETTE FORMAT

INTRODUCTION

Appendix C provides the format for installing custom color palettes for use by MMCPC when processing source FIAF geotiff files into CADRG-like files compatible with the TAMMAC Digital Map System. The color palette is an ASCII file containing a maximum of 216 colors as shown in Fig. C1. Color palettes are used by MMCPC to transform source geotiff files from 24-bit color to 8-bit color (i.e. color compression). MMCPC is installed with a default set of 8 color palettes (one per supported map scale: 1:5M, 1:2M, 1:1M, 1:500k, 1:250k, 1:100k, 1:50k, and 1:12.5k) derived from NGA source CADRG. A custom color palette is installed in MMCPC during data processing of FIAF geotiff into CADRG. A custom color palette must reside in the appropriate scale directory (Fig. A1) with the set of geotiff files that will be processed. Only one color palette is allowed per scale and it must be named **PALETTE.TXT**. Once processing begins, the custom color palette will replace the default color palette for that particular map scale. The custom color palette becomes the new default palette for that scale and will then be used to color compress the source geotiff files at that scale into CADRG files. A **PALETTE.TXT** file may exist in each map scale directory that contains geotiff files. Custom color palettes that provide good representations of the true colors of the source data are recommended to reduce the impact of color loss during processing.

FIAF COLOR PALETTE FORMAT

MMCPC requires that a custom color palette file (**PALETTE.TXT**) follow a very specific format as shown in Fig. C1. The first line of the color palette file must contain the number of colors that will follow. The *maximum* number of colors is 216. If the actual number of colors does not match the number listed in the first line, the file will be considered incorrect and the map data will not be processed. After the first line, each successive line must contain the text: “Set x” where “x” is the numeric identifier of the color (e.g., “Set 216”). These numbers should be consecutive. Please note that the “S” in “Set” must be capitalized. Following the text, the red, green, and blue values (valid values 0-255) for the color follows with each value delimited by a single space. In Fig. C1, spaces are shown as “ ” for clarity.

```

154
Set 1 0 0 0
Set 2 33 0 209
Set 3 64 0 128
Set 4 117 130 117
.
.
.
Set 152 89 97 97
Set 153 36 138 255
Set 154 0 99 15

```

Fig. C-1 — FIAF custom color palette format; this sample palette has 154 colors (216 is the maximum number of colors).

Appendix D

MPS IMPORT FILE FORMAT

INTRODUCTION

The MPS import file is an ASCII file that interfaces between the MPS system and MMCPC. The MPS must generate this file if a particular set of map data and/or data frames is required from MMCPC. All MPS import files must have the file extension *.MPS.

MMCPC can read MPS import files and create MMCPC composition from the file contents. The user may import an MPS file into MMCPC from any directory or hard drive available to the MMCPC computer. Further, source files for data frames listed in an MPS import file may exist in any available directory or hard drive available to MMCPC. However, the full path name for each data frame is required. Note that all source files for data frames must be 768x768 pixels in size, as required by TAMMAC.

Resultant mission builds are stored in the MMCPC directory C:\MMCPC\TAMMAC\MISSION. A file folder will exist with the name given in the MPS file. All required files for a valid TAMMAC mission load will exist in this directory EXCEPT the MF.DAT file, which must be created by the MPS system.

FILE FORMAT

The MPS import file format is shown in Fig. D1. Figure D2 displays the contents of the MPSIMPORT.MPS file used in this ATP. This example may be referenced in the construction of a valid MPS import file.

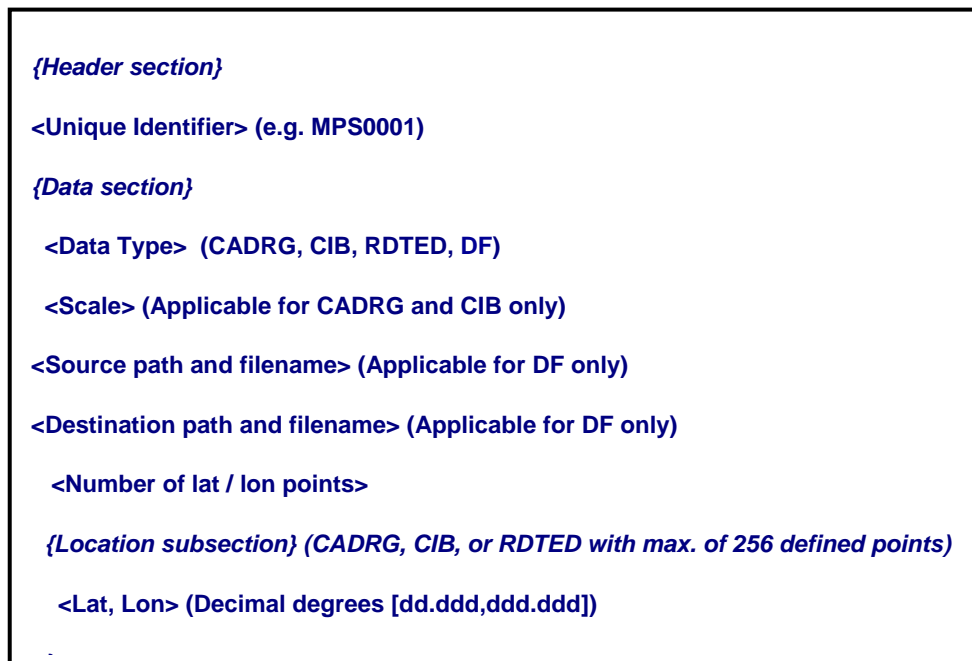


Fig. D1 —MPS Import file format

The MPS import file is divided into three sections: *header*, *data*, and *location*. The *header* section contains the unique mission name that will be assigned for its MMCPC composition name. The maximum length of this name is 10 characters and may not include spaces or special characters. The mission name is followed by a number indicating how many data sections follow. An exclamation point (!) in the first column indicates a comment field and is ignored during import.

The *data* section identifies map data type, scale, and source/destination directories for data frames. Valid map data types are CADRG, CIB, RDTED, and DF (data frames). Valid map scales for CADRG data are 1:12.5k, 1:50k, 1:100k, 1:250k, 1:500k, 1:1M, 1:2M, and 1:5M. Valid map scales for CIB data are 5m and 10m. The only valid map scale for RDTED is 150m. Data frames are not georeferenced, and can be at any scale. Source and destination paths for data frames must specify the full directory path and file name (e.g., C:\mmcp\import\test.gif).

The *location* section is applicable for CADRG, CIB, and RDTED data types. The first entry in this section lists the number of coordinates that follow for that particular *data* section (e.g., CADRG @ 1:2M). This is followed by the latitude and longitude coordinates specified in \pm decimal degrees, delimited by a comma.

```
ATP4
! Composition title
5
! Number of sections to follow
! CIB has 2 scales [5m (5 meter) 10m (10 meter)]
CIB
5m
4
61.5,024.5
62.5,024.5
62.5,025.5
61.5,025.5
! CADRG has 8 scales [1:12.5k,1:50k,1:100k,1:250k,1:500k,1:1M,1:2M,1:5M]
CADRG
1:250k
4
61.5,024.5
62.5,024.5
62.5,025.5
61.5,025.5
CADRG
1:2M
4
61.5,024.5
62.5,024.5
62.5,025.5
61.5,025.5
! Both scales of RDTED 750m and 150m are always included
! Always specify 150m
RDTED
150m
4
61.5,024.5
62.5,024.5
62.5,025.5
61.5,025.5
! Data frames - specify source dir and name / destination dir and name.
! DF
! C:\MMCPD\import\STOOGIES.GIF
! C:\MMCPD\data\DATAFRAME\stoogies.hdf
DF
C:\MMCPD\import\faf.gif
C:\MMCPD\data\DATAFRAME\FAF.hdf
```

Fig. D2 — MPS import file example (MPSIMPORT.MPS)